**NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ PER. \_\_\_\_**

**MEASURING THE EFFECT OF LIGHT INTENSITY ON PHOTOSYNTHESIS**

**INTRODUCTION**

Photosynthesis captures energy from sunlight. Plants, algae and some bacteria use the energy captured during photosynthesis for their metabolism (all the chemical reactions in an organism). During photosynthesis in green plants, chlorophyll and enzymes in the leaves convert certain wavelengths of light into chemical energy. Photosynthesis can be represented by the following equation:

(sunlight)

6CO2 + 6H2O 🡪 C6H12O6 + 6O2

**BACKGROUND**

In this laboratory investigation, you will examine the relationship between the amount of light energy available and the rate of photosynthesis by observing the plant’s use of carbon dioxide.

Carbon dioxide in one of the reactants necessary for photosynthesis. Absorption of carbon dioxide by green plants can be used to determine if photosynthesis is taking place or not.

Bromothymol blue (BTB) is an indicator which turns blue in the presence of oxygen and yellow in the presence of carbon dioxide.

By placing plants into a solution of (BTB) to which carbon dioxide has been added and then placing the plants are various distance from the light, the relationship between the intensity of light and the rate at which photosynthesis occurs can be determined.

**PRE-LAB DISCUSSION**

Read the **ENTIRE** investigation and answer the following questions.

1. What are the independent and dependent variables in this experiment?

Independent variable:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Dependent variable: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. What are the controls in this experiment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3. How will you provide carbon dioxide (CO2) to the plants? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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4. How will you know if the carbon dioxide has been absorbed by the plants? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

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5. How will you keep the plants from interacting with the atmosphere in the classroom? \_\_\_\_\_\_

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6. How do you expect the light intensity to affect the color of the BTB? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**HYPOTHESIS** – Make a hypothesis for this experiment.

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**MATERIALS**

8 test tubes

Test tube rack

Straw

Wax pencil

Metric ruler

Label tape

BTB solution

4 pieces of green plant

**PROCEDURE**

1. Measure each test tube 4 cm from the top and mark this with the wax pencil.

2. Take your marked test tubes to the front of the classroom and fill each test tube with the BRB solution to the line you made in step 1.

3. Label each of your test tubes with your group number, period number and the distance from the light (see the data table).

4. Using the straw, **GENTLY**, blow into the BTB solution until it turns yellow/clear.

5. Get 4 pieces of plant from your teacher and place these into one test tube for each distance from the light.

**Note: you will have two test tubes for each distance – one will have a plant in it and one will not.**

6. Place your test tubes in the test tube racks that are set up by the lamps at different distances.

**Note:** **you will place two test tubes at 10 cm (one with a plant and one without a plant), two test tubes at 20 cm, etc.**

7. Note the time that you placed the test tube at the distances in Data Table 1.

8. Observe the test tubes at the end of the lab period and the next day to determine when the test tubes change color. Mark this in Data Table 1. Make sure you make a TITLE for your Table.

**RESULTS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Distance from light** | **Contents of test tube** | **Time placed in light** | **Time of color change** | **Amount of time for color to change** |
| **10cm** | No plant |  |  |  |
| **10 cm** | Sprig of plant |  |  |  |
| **20 cm** | No plant |  |  |  |
| **20 cm** | Sprig of plant |  |  |  |
| **40 cm** | No plant |  |  |  |
| **40 cm** | Sprig of plant |  |  |  |
| **50 cm** | No plant |  |  |  |
| **50 cm** | Sprig of plant |  |  |  |

**Table 1:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Make a line graph (2 lines) of the data from table 1. On the x-axis is where your independent variable goes and you dependent variable goes on the y-axis.

**CONCLUSION**

1. In the test tubes that contained plant sprigs, how did distance from the light affect the time required to see a color change? Explain this result.

2. Were there any test tubes in which you did not see a color change? Why?

3. Was your hypothesis supported by the data in this experiment?

4. Explain how light intensity affects the rate of photosynthesis.

5. What would happen if placed a sprig of the plant in the BTB solution in the dark.